Does sex-ratio indicate the extent of male preference?: A quest for better indicator

Singh, Indervir and Singh, Sarbjit
Centre for Development Studies, Prasanth Nagar, Ulloor, Trivandrum, Kerala, India, PUNJABI UNIVERSITY

25. September 2007

Does Sex-ratio Indicate the extent of Male Preference? A Quest for Better Indicator

Indervir Singh
Centre for Development Studies, Thiruvananthapuram, Kerala, India
Email: indervirs@gmail.com

Sarbjit Singh
Department of Statistics, Punjabi University, Patiala, Punjab, India
Email: kakabrar@gmail.com

Abstract

This paper shows that the use of sex-ratio as an indicator of preference for male is not an appropriate selection, as sex-ratio also depends up on fertility rate in any society. The findings points out that by comparing sex ratios across societies, one may find trivial conclusion with regard to people having male preferences if the societies differ in their fertility rates. Similar mistake can also happen while comparing sex-ratios across different points of time if the fertility rate is changing over the time period. Consequently, paper proposes an alternative method to know the extent of male preference.

Key Words: Male preference, Sex-ratio, Fertility rate.

JEL No. J1, Z1

1. Introduction

One of the major social problems in India is male preference which is the main reason behind female feticide, and leads to the odd sex-ratio. A huge volume of literature on male preferences has discussed the effect of the odd sex-ratio, and researchers suggest policies to tackle this problem. However, these studies (for example, Bhat, 2002; Das and Bhat, 1995 and many other) misunderstand sex-ratio as an indicator of female feticide or as an indicator of people following social norm of male preference. Further, Son preference is not a norm in itself; rather it is the result of some social customs and norms. These social norms make male child more important than the female child throughout the life of parents. For example, in Hindu religion it is believed that a person will go to heaven only if his/her son performs last rituals after his/her death. Moreover, patriarchal system is followed in almost whole India where male is breadwinner of the family who is also supposed to take care of his parents. On the other hand, girls are always considered liabilities on the fact that the social customs discourage the dependence of parents on their daughter. Hence, even those people, who do not hate or dislike daughters, prefer to have at least one boy to avoid suffering in their old age. This argument is also supported by the data from 'National Family Health Survey-2' report which finds that 85 percent of the people in India want at least one son and at the same time, 80 percent people desire for at least one daughter. Nonetheless a preference for a girl child is not strong enough to cause feticide because unlike in the case of son, social norms do not create any disincentive for the parents who do not have any daughter. This signifies that in the first case, stated preferences are revealed preference too, whereas in the second case, stated preferences are different from revealed preferences. Given this situation, the two new developments, which happened in last few decades, have affected the situation in a profound way. First important development is the increase in awareness about family planning which resulted into more preference for small families. Second major development is the availability of technology to detect sex of fetus at the earlier stage of pregnancy. Due to these developments, people have started planning number of children earlier and opt for abortion in case they do not have any son earlier and trying one more time means exceeding their planned limit of children. Nonetheless, the studies, which discuss negative impact of male preference, talk about the second development only, that is, more feticide due to easy availability of medical technology. These studies consider sex-ratio as an indicator for the male preference that is lesser the sex ratio more will be the male or son preference or visa-versa,

whereas the first development is discussed in relation to the decreasing fertility rate. However, there can be a strong relation between sex-ratio and fertility because probability of having at least one son, without any abortion, increases with increase in fertility rate. It is in this context, present study proposes a method to calculate male preference by considering both sex-ratio and fertility rate. This paper is divided into five sections including introduction in first section. Second section deals with the decision making of individuals in relation to abortion. Given the pattern of decision making by people, problems related to the usage of sex-ratio as an indicator for male preference is discussed in the third section. Fourth section proposes the new method for calculating male preference and highlights its superiority over sex-ratio as an indicator for male preference. Fifth section highlights the importance of new method in Indian context. The results conclude in the last section.

2. Decision Making by Parents

A couple gets some benefits from having a child such as utility from being parents, expected care in their old age, social or religious utility and so on. Similarly, a couple has to bear some costs for giving birth to a child such as health loss for women, expenditure on food, clothing, and education of a child, less care for their earlier children, and so on. Therefore a couple's decision, about giving birth to a child or abortion, depends on cost and benefit of it. If giving birth to a child has both benefits and costs, then a couple will give birth to a child only if benefits from giving birth are equal to or exceeds the cost associated with it. For a couple marginal benefits from giving birth to another child will be diminishing as some of the desires of couple are already fulfilled from earlier children. However, marginal cost will be increasing in all the times due to increase in costs such as increase health loss for women. Therefore, every couple would like to have a number of children where their benefits are more or at least equal to costs. However, the fact, that people get different benefits and costs from having a son than a daughter, adds complexity to the situation. In a society where son is preferred over daughter, a couple will have higher pay-off from having a male child than a female. But there may also be many situations for example for first child people have preference for son but if first child is son then utility from having second son can be less than having a daughter (that is couple's benefits from having one son and one daughter child are higher than having two sons) or their may be more utility from a son in all cases (that is, a son is always preferable than a daughter). There can be

other situations too, for example benefits from having a daughter exceeds than a son only after having two or more sons.

Generally speaking, having a male or female child is a natural phenomenon and both have an equal chance of taking birth. Therefore to have a son, a couple can choose either to have more children or go for feticide till a son is born. To model the situation, let us assume that a couple's comparative benefits from a son or a daughter lies on the social norms which are same for all couples in a prevailing society, though the extent may differ from one couple to another. Suppose, 'C' represents child and is the set of two possible outcomes, son (S) or daughter (D), that is $C= (S, D)$. Total benefits of having a son or daughter is $B_S(S_n, C_i)$ and $B_D(D_n, C_i)$ respectively. Here, 'i' represents the number of present child among all the children and i= 1, 2, 3,….m, whereas 'n' is number of the son or daughter with n= 1, 2, 3…..k where 1, 2,3 and k refer to as 1st, 2nd, 3rd and kth son or daughter. Now, again assume that the cost of having a child, regardless of the sex of child, depends up on the number of the child only. Therefore, cost of having a son or a daughter is $C(C_i)$. Further, feticide (F) also has a cost which can be health related, psychological or societal. Suppose that the feticide exerts a cost $C(F_t)$ on a couple where t denotes the number of the abortion and t= 1, 2, 3,…l. Given these benefits and costs, a couple maximizes the net benefits,

that is, $$Max \{ \sum_{i=1}^{m} \sum_{n=1}^{k} B_S(S_n,C_i) + \sum_{i=1}^{m} \sum_{n=1}^{k} B_D(D_n,C_i) - \sum_{i=1}^{m} C(C_i) - \sum_{t=1}^{l} C(F_t) \} \quad (1)$$

Based on equation 1, the possible moves of a couple can be predicted as they will take the decision about number of children and abortion of a fetus in such a way that their net benefits are maximized. First of all, it is important to discuss how a couple decides about the number of children. A couple chooses to have a child till the marginal benefits from having a child are more than the marginal cost. In a normal situation when feticide is not an option for the couple and the cost of having a child is same for both a son and a daughter; the marginal benefits will be the sum of expected marginal benefits from a son and expected marginal benefits from daughter (here expected value is the product of marginal benefits and probability of happening the event). Now, the decision process of a couple, who has decided the number of children and prefer one gender to other, can be analyzed by incorporating the option of feticide in the earlier discussion.

Though, many situations of gender bias can be thought of for analyzing the decision making process of a couple, nonetheless three most plausible situations are considered to simplify the discussion. First, assume that when a couple is asked to choose among different bundles of children, where each bundle has same number of total children but the ratio of male to female child varies, then the couple would always prefers a group which has more number of male children than the other. In second situation, after having one son, the benefits of a couple from having a son or a daughter equalize. Third, assume that initially a couple prefers a son to a daughter; however in case the couple has one or more sons and no daughter, then the benefits of having a daughter exceeds the benefits of a son. Here, the benefits equalize once the couple has at least one son and one daughter.

Though, a couple may always prefers a son to a daughter, yet having more children will give both more sons as well as more daughters. This is due to the reason that one cannot avoid daughters except through feticide. However, feticide also has certain costs which can be societal, health related, legal and so on (remember that in this case people's preference for a son over a daughter does not mean that people prefer not to have a daughter, and people may prefer a son to a daughter, whereas they may prefer daughter to no child). Therefore, a couple will go for feticide only if the difference, between the benefits of having a son and benefits of having a daughter, exceeds the cost imposed by feticide. Further, assuming that marginal benefits of having daughter or son decreases (that is, if a couple values a son less if they already have a son and the benefits decreases, further, for the third son), the difference between benefits from having a son or a daughter will increase with the birth of each daughter, which, in turn, enhances the chance of feticide. Nevertheless, a couple may delay the feticide if the present child is not the last one and once a son is born, the difference of benefits is going to come down below the cost of feticide.

Discussing the second case, where once a son is born to a couple, benefits from having a son become equal to the benefits from a daughter. In this situation, a couple will not go for feticide till the last expected child is also a daughter as benefits from a son do not depend on his being first or last child. Therefore, a couple will choose feticide only if the last expected child is also a daughter like all the previous children and difference of benefits from a son and a daughter exceed the cost of feticide so that net benefits can be maximized.

Third situation generate the possibility of feticide for both the genders and the potential victim of feticide will be the last expected child. However, the decision for feticide will depend on the difference of benefits of a child of preferred gender and a normal child. Here, we used the word 'normal child' instead of less-preferred gender because the benefits from a child can be divided into benefits of having a child and benefits from the sex of child and the benefits, which are related to the sex of child, vanish after the birth of a child of that sex. Therefore, a child, who is a less-preferred sex (that is the couple already has a child of that sex), posses the benefits of a normal child only. Here, a male and a female child may differ in terms of their sex related benefits; consequently, the desire of a having a child of a sex, who has higher difference of benefits over the normal child, may succeed in motivating a couple for feticide, whereas other child of other sex may not do so due to its lower benefits.

In Indian milieu, the prevailing situation is more similar as third type, that is both a son and a daughter has gender related benefits for a couple. This is also evident from 'National Family Health Survey- 2' (NFHS-2) report as already elaborated at length in the introduction. Therefore, the first situation can be ignored in an Indian case (at least for most of India). Put it differently, this means that the most of the feticide happens in the case of last child, when a couple does not have any other option to avoid the cost of feticide.

Based on these arguments, the next section discusses the effect of this situation on sex-ratio and also throws light on the problem arises while using sex-ratio as an indicator for male preference.

3. Problems of using Sex-ratio as an Indicator for Male Preference

To understand the problems, let us assume two societies, A and B. Both the societies have the norm of male preference and practice female feticide. Suppose that all the people in both the societies follow the norm (here following norm means practicing female feticide). Assume that the total numbers of children per couple are decided exogenously, but the people in both the societies want at least one male child. For simplification, suppose that society A gives birth to three children per couple, whereas society B has two children per couple. Now, assuming that people will go for female feticide only if the last child is going to be a daughter and the couple has no son before (considering our earlier discussion, it is not an unrealistic assumption). Given

these conditions, society A will have 3000 children per 1000 couples and this number will be 2000 per 1000 couples for society B.

Given this situation in society A, a female child, if in first two children, will not be replaced by male child, and the third child, if female, will be replaced by male only if the couple has no male child so far. Therefore in case of society A, total number of females replaced by males, in last 1000 children, will be 125, (number of couple ∗ probability of having three consecutive female children, that is, 1000* 0.125).[1] In other words, 125 females per 3000 children (or 41.67 female children per 1000 children) will be replaced by males in society A. Similarly in case of society B (which has two children per couple) 250 children in last 1000 children (or 125 female children per 1000 children)[2] will be replaced by males. Though in both the societies, same percentages of people follows the norm, the resultant sex-ratio due to feticide will be different in both the cases, this is due to the reason that the number of females, replaced by males per 1000 children, are different in both the cases. Same argument also applies to a society which is shifting from higher fertility rate to lower fertility rate. This example shows that by using sex-ratio as an indicator of norm, one can arrive at a wrong conclusion about the extent of male preference in a society Therefore, it is important to find a new method for measuring male preference and the next section is an attempt in this direction.

4. Method to Measure the Male Preference

The discussion, in earlier sections, shows that the sex-ratio is the result of male preference rather than as an indicator of male preference. Though the importance of sex-ratio, in the discussion of male preference, cannot be denied, the interpretation on this basis can be misleading if it is considered as an indicator for male preference. This section proposes a new method to calculate the percentage of people who follows norms. The proposed method uses the expected sex-ratio and actual sex-ratio to find out the extent of male preference. The following four assumptions are made about the society to draw the method:

---

[1] Probability of having female child or male child is 1/2 and all events are independent of each other. Therefore probability of having three consecutive female children without any male child will be equal to (1/2)*(1/2)*(1/2)= 1/8 = 0.125

[2] 250 female children per 1000 couples (1000*0.250 = 250) or 2000 children.

1. Assume that the people have preference for male child and want at least one male child, but there is no disliking for daughters.

2. Assume that the total number of children of a couple are fixed and decided exogenously, that is their number do not depend on male preference. Therefore, people will not choose to give birth to more children to get a son and rather choose female feticide (as they will not exceed number of children more than already decided).

3. People will not stop giving birth to children if the first child is a male and they will give birth to the decided number of children.

4. A couple will go for feticide only if the last expected child is a female and the couple has no son so-far.

Based on these assumptions, predicted number of females replaced by males[3] can be found for a society in which all people follow the norm. Predicted numbers of females replaced by males in any society will be $\sum_{i=1}^{n} C_i\{p(F)\}^i$. Here, C_i denotes number of couples[4] who want 'i' number of children, and p(F) is the probability of having a female child. Since the study assume that the feticide can happen only in the case of last child, number of couples can be taken as representative of the number of children prone to feticide. However, all people may not be following the norm, therefore actual number of females replaced by males may be different than the predicted. The actual number of replacement can be found from the prevailing sex-ratio in a society. If there are 'n' number of females per 1000 males in a society, then the number of females replaced by males for $n+1000$ children will be $(1000-n)/2$. From this we can find the

[3] Here, we are using the term 'females replaced by males' rather than 'female feticide' because the number of feticide can be more than females replaced by males. This is because among all the people, who go for feticide, only half will get son and the rest of them have to choose feticide again. For example, at first the number of feticide for the couples, who want just two children, will be 125 (which is actual females replaced by males), however, out of these 125 couples only half will get a son in the next attempt and rest of them, that is 62.5 couples, has to choose feticide again and this will continue till all couples get at least one son. In this way, the total number of feticide will be = 125+ 1/2*(125) + $(1/2)^2$*(125) + $(1/2)^3$*(125) +___= 250.

[4] The study has taken number of couples to find the fertility rate rather than the number of females. We have used number of couples for this purpose because giving birth to a child is generally a couple's decision.

number of replacement for total number of couples in the studied society. Now, the ratio of the actual replacement (of females by males) to the predicted replacement (of females by males) will give the share of the couples (or people) who are following the norm of male preference.

The use of method can be illustrated with the help of an example. Suppose, there are three types of couple, first who want 'two' children, second who want 'three' children and third who desire to have 'four' children. Suppose that there are 1000 couples in a society and the numbers of couples with two, three and four children are 400, 400 and 200 respectively, and give birth to 800, 1200 and 800 children in that order. Now, probability of having two, three and four consecutive female children is 0.25, 0.125 and is 0.0625, respectively. Given these conditions, if all the couples choose to go for feticide to get a son, then the predicted number of females replaced by males (R_p) will be:

$R_p = C_2*\{p(F)\}^2 + C_3*\{p(F)\}^3 + C_4*\{p(F)\}^4$

Or $R_p = 400*0.25 + 400*0.125 + 200*0.0625 = 162.5$

Now, predicted number of children to all couples is 2800 and the predicted number of females and males in absence of norm are 1400 each (as the probability of having a female child or male child is ½). But 162.5 females are replaced by males due to the male preference, therefore the predicted number of females and males in case of norm will be 1237.5 and 1562.5 respectively.[5]

Now, suppose that actual number of females per 1000 male is 900, that is, 900 females in 1900 total children. However, in ideal situation it should be 950 and 950. Hence, the actual number of females replaced by males (R_a) for 1900 children is 50, and it is 73.68 (that is, 2800/1900*50) for 2800 children.

The actual replacement of females by males per 2800 children is 73.68, which is lesser than the predicted 162.5. This means that all people are not following the norm. The relation between the actual and the predicted replacement is:

R_p * (share of people following norm) = R_a

[5] The predicted sex-ratio in this case is 792 female per 1000 male.

That is, the percentage of people following norm = $(R_a/ R_p)*100$ =(73.68/162.5)*100 = 45.34 percent

Now, if we consider that there is no couple with two children and out of 1000 couples 600 are having three children and remaining 400 are having four children. The predicted number of total children is 3400 and predicted number of females replaced by males is 100 (that is, 600*0.125 + 400*0.0625) and the number of males and females will be 1800 and 1600 respectively.[6] And, if we take actual sex-ratio same as that of the previous example, the actual number of females replaced by males for 3400 children will be 89.47 (that is, 3400/1900*50). Hence, the percentage of people following norm is 89.47 (that is, 89/100*100).

Though the actual sex-ratio is same in both the examples, the results, about the number of persons following the norm or having male preference, are much different from each other. This is because the predicted sex-ratio can be different even when actual sex-ratio is same. This happens due to the difference in the fertility rate in two situations. This signifies the importance of the proposed method in finding the change in norm over the time. Another advantage of this method is that the future sex-ratio of a society can predicted, if the fertility rate is decreasing.

Here, one more thing, which should be made clear, is that from fertility rate does not mean just average fertility, and the distribution aspect of fertility is also considered. To make the point clearer assume two societies with 1000 couples each. In the first society, half of the couples (that is 500 couples) want 2 children and remaining half want 4 children. In second society, one half of the couples wants 1 child only, and other half wants 5 children. In both the cases, there will be total 3000 children and average children per couple will be 3. However, the predicted feticide in first and second society, for 3000 children, will be 156.25 and 265.625 respectively. This difference is due to the difference in distribution around average fertility.

[6] Therefore, predicted sex-ratio, in this case will be 889 females per 1000 males {(1600/1800)*1000}.

5. Significance of Method in Indian Context

To strengthen our argument, the importance of the proposed method becomes clearer from the comparison of total fertility rate (TFR) figures for the period 1992-93 and 1998-99, and sex-ratio for the year 1991 and 2001 (see Table 1). It is clearly evident from the data shown in the Table 1 that sex-ratio is not improved in many of the Indian states. This finding, however, does not mean that male preferences are increasing or not decreasing, because the fertility rate is also declining over this time period for all the states. Therefore, the worsening of sex-ratio could be due to declining fertility rate or increasing male preference or a mixed effect of both. Moreover, the male preference in the states, which are showing improvement in sex-ratio with decline in fertility rate, has definitely come down, however the extent of decline in male preference cannot be compared solely based on improvement of sex-ratio and change in fertility rate also has to be incorporated.

Table 1: Total Fertility Rate and Sex-ratio

States	1992-93	1998-99	1991	2001
	NFHS-1 TFR (Age 15–49 Years Women)	NFHS-II TFR (Age 15–49 Years Women)	Sex-ratio	Sex-ratio
Andhra Pradesh	2.59	2.25	972	978
Assam	3.53	2.31	923	932
Bihar	4.00	3.49	907	921
Gujarat	2.99	2.72	934	921
Haryana	3.99	2.88	865	861
Himachal Pradesh	2.97	2.14	976	970
Karnataka	2.85	2.13	960	964
Kerala	2.00	1.96	1036	1058
Madhya Pradesh	3.90	3.31	912	920
Maharashtra	2.86	2.52	934	922
Orissa	2.92	2.46	971	972
Punjab	2.92	2.21	882	874
Rajasthan	3.63	3.78	910	922
Tamil Nadu	2.48	2.19	974	986
Uttar Pradesh	4.82	3.99	876	898
West Bengal	2.92	2.29	917	934
India	**3.39**	**2.85**	**927**	**933**

Source: National Family Health Survey-2 Report and Census of India 1991, 2001.
Note: TFR = Total Fertility Rate

Further, there are large differences in the fertility rate across Indian states. This again indicates that even if the sex-ratio for one state is lesser than the other, the male preference in that state may not be higher if the fertility rate in second state is higher. For example, Bihar and Gujarat have same sex-ratio in 2001; however one can predict the higher male preference for Bihar as the fertility rate of Bihar is much higher than Gujarat (assuming the similar distribution of fertility for both the states). Similarly, Uttar Pradesh (UP) can be considered of having higher male preference in 1991 than Punjab as for approximately similar sex ratio in both the states, UP has much higher fertility rate. Whereas, West Bengal (WB) is likely to have lesser male preference than Punjab as with approximately same fertility rate in 1992-93 and 1998-99, WB has much higher number of females per 1000 males than Punjab. However, the above comparisons are based on the assumption that the distribution of fertility around total fertility rate is similar for all the states, and results may differ if the assumption does not hold good. Nonetheless, the purpose of comparison is not to give the relative status of Indian states, and rather this aims to demonstrate the significance of proposed method in Indian situation. In this sense, these comparisons have served the purpose well.

6. Conclusion

The paper argues that the people make decision so that net benefits can be maximized. Therefore, the comparative benefits of a male and a female child play a decisive role in female feticide. This assumes more importance in a country like India, where each gender has a certain type of benefits, and the extent of feticide depends up on the benefits related to the specific gender. Given these cost-benefit calculations, the things can be much different when the people have preference for fixed number of children, and the fertility rate is different for different societies, which may, further, be changing over the time period. In this context, predicting male preference on the account of sex-ratio is trivial due to the fact that sex-ratio is influenced by both male preference as well as fertility rate. However, the present studies, while comparing societies, consider the sex-ratio as an indicator of male preference and does not adjust for difference in the fertility rate among these societies. Therefore, it is imperative to separate out the effect of fertility rate from sex-ratio to get the effect of male preferences. The method, proposed in this paper, takes care of this problem, and, hence, is a better way to indicate the male preference. Moreover the number of females replaced by males is different from the total number of feticide.

Due to the large differences in fertility rates among regions of India and fast changing fertility rate over the time, there is immense need to rethink the sex-ratio as an indicator of male preference and move to a better indicator as tried in the paper.

References

Agnihotri, Satish Balram (2000) "*Sex Ratio Patterns in the Indian Population: A Fresh Exploration"*, New Delhi: Sage.

Arnold, F., M. K. Choe and T.K. Roy (1998) "Son Preference, The Family- Building Process and Child Mortality in India", *Population Studies*, 52: 301-315.

Bhat, P. N. Mari (2002) "On the Trail of 'Missing' Indian Females: Search for Clues", *Economic and Political Weekly*, 37 (51): 5105-5118.

Bhat, P. N. Mari, A. J. Francis Zavier (2007) "Factors Influencing the Use of Prenatal Diagnostic Techniques and the Sex Ratio at Birth in India", *Economic and Political Weekly*, 42 (24): 2292-2303.

Bose, Ashish (2001) "Fighting Female Feticide: Growing Greed and Shrinking Child Sex Ratio", *Economic and Political Weekly*, 36 (36): 3427-3429.

Gupta, Das, M. and P.N. Mari Bhat (1995) "Intensified Gender Bias in India: A Consequence of Fertility Decline", Working Paper 95-02, Harvard center for Population and Development Studies, Harvard.

Government of India (1991) "Census of India 1991"

Government of India (2001) "Census of India 2001"

National Family Health Survey- I 1992-93

National Family Health Survey- II 1998-99

Miller, Barbara D. (1997) "*The Endangered Sex: Neglect of Female Children in Rural North India*", Delhi: Oxford University Press.

Sudha, S. and S. I. Rajan (1999) “Female Demographic Disadvantage in India 1981- 1991: Sex Selective Abortions and Female Infanticide”, *Development and Change*, 30 (3): 585-618.